les 3 (the combination of the spherical bearing surface 55 or 55*a* with the spherical cup 57).

What is claimed is:

1. Spinal osteosynthesis device comprising at least two bone-anchoring elements (1; 31) for anchoring in respective bodies (S, L5) of the bone structure of the spine, at least one member (2; 16) for longitudinally connecting the bone-anchoring elements, and shackles (3) for connecting the bone-anchoring elements together, each bone-anchoring element comprising a head (5; 33) for grasping with a screwing tool (6), a threaded shank (7) extending the head for grasping, and a tightening element (8) which can be fitted onto this shank to immobilize the assembly comprising the connector shackle, the longitudinal connecting member and the corresponding bone-anchoring element, characterized in that the threaded shank (7) has a ball end (11) for articulation in a housing (12) of a spherical cup (57) of the head (5) for grasping, allowing the shank (7) to be oriented in many directions, and allowing the connecting shackle (3) to be positioned to suit the configuration of the vertebral segment (S, L5, . . . L2) receiving the bone-anchoring element, and in that the ball (11) and the cup (57) have respective centres of rotation (R1, R2) which are separated by a distance (S), giving the device, when tightened using the tightening element (8), by bearing against the spherical cup (57) of the head (5) for grasping, a function of returning the bone-anchoring element by transverse force, the connector shackle for this purpose having a spherical bearing surface (55) articulated to a portion of the spherical surface of the cup (57) of the head (5) of the bone-anchoring element.

2. Device according to claim 1, characterized in that the threaded shank (7) and the connecting shackle (3) are equipped with means for immobilizing the shank and its ball (11) in terms of rotation once the threaded shank has been introduced into a corresponding through-hole (10) through the shackle.

3. Device according to claim 2, characterized in that the said means comprise at least one rotation-stopping geometry, preferably two, namely a first rotation-stopping geometry (13) formed on a collar (14) arranged between the ball and the contiguous end of the threaded shank (7), and a second, female, rotation-stopping geometry (15) formed on the interior edge of the hole (10) in the shackle (3), this second rotation-stopping geometry being designed to press against the first rotation-stopping geometry once the shackle has been fitted on the threaded shank.

4. Device according to claim 1, characterized in that the opposite end of the threaded shank (7) to the ball (11) consists of a male shape (21), for example a half-moon shape, designed to cooperate with a complementary female shape (23) of a tool (6) so as to immobilize the ball in terms of rotation while the tightening element (8) is being screwed onto the threaded shank (7).

5. Device according to claim 1, characterized in that the ball (11) is held in its housing (12) by assembling (for example screwing, crimping, welding, etc.) the edge of the latter around the ball.

6. Device according to claim 1, characterized in that since the surface of the cup (57) of the head (5) is hemispherical and interrupted in the polar region to receive the ball (11), the associated spherical surface (55) of the shackle (3) at least partially covers the hemispherical surface of the cup, so as to produce either an effect of returning the bone-anchoring element (4) towards the axis, when coverage is total, as far as the equator of the cup, or a slight return, roughly maintaining the initial angular position of the bone-anchoring element, when coverage is only partial.

7. Device according to claim 6, characterized in that the connecting shackle (3) has a conical bearing surface (56) for the tightening element (8), this surface being connected to the said spherical surface (55).

8. Device according to claim 1, characterized in that it further comprises at least one bone-anchoring element (31) comprising a threaded anchoring shank (32), a head (33) which has a transverse collar (34) and a shape (35) for grasping, for screwing, and a threaded shank (7) extending the head, the assembly being all of one piece.

9. Device according to claim 1, characterized in that the threaded shank (7) has a narrowed portion (18) delimiting two threaded regions (17) and (19) of this shank and constituting an initiator for breakage once the tightening element has been assembled and fitted on the connecting shackle, this narrowed portion therefore allowing the shank (7) to be broken.

10. Device according to claim 1, characterized in that the member for longitudinally connecting the bone-anchoring elements (1) is a vertebral rod (2) passing through the shackles (3) for connecting to the bone-anchoring elements.

11. Device according to claim 1, characterized in that the member for longitudinally connecting the bone-anchoring elements (1) and (31) is a plate (16) in which there are formed cylindrical and/or oblong openings (41, 43) delimiting possible locations for the bone-anchoring elements and through which the threaded shanks (7) on which the immobilizing tightening elements (8) are fitted pass, and in that the openings in the plate (16) have a similar outline to that of the hole (10) in the connecting shackle (3) so as likewise to fulfil a function of returning the bone-anchoring element.

12. Device according to claim 1, characterized in that it comprises a system for transversely connecting the bone-anchoring elements (1), this system being formed of a pair of dished elements (58, 59) each of one piece with a tab (61, 62), the relative position and therefore the separation between the dished elements being adjustable for example by means of a screw-nut assembly (63, 64) passing through an elongate slot (65) in one tab (61) and a tapped hole in the second tab (62).

13. A system for installing bone anchoring element, comprising:

a spinal osteosynthesis device comprising at least two bone-anchoring elements (1; 31) for anchoring in respective bodies (S, L5) of the bone structure of the spine, at least one member (2; 16) for longitudinally connecting the bone-anchoring elements, and shackles (3) for connecting the bone-anchoring elements together, each bone-anchoring element comprising a head (5; 33) for grasping with a screwing tool (6), a threaded shank (7) extending the head for grasping, and a tightening element (8) which can be fitted onto this shank to immobilize the assembly comprising the connector shackle, the longitudinal connecting member and the corresponding bone-anchoring element, characterized in that the threaded shank (7) has a ball end (11) for articulation in a housing (12) of a spherical cup (57) for the head (5) for grasping, allowing the shank (7) to be oriented in many directions, and allowing the connecting shackle (3) to be positioned to suit the configuration of the vertebral segment (S, L5, . . . L2) receiving the bone-anchoring element, and in that the ball (11) and the cup (57) have respective centers of rotation (R1, R2) which are separated by a distance (S), giving the device, when tightened using the tightening element (8), by bearing against the spherical cup (57) of the head (5) for grasping, a function of returning the

bone-anchoring element by transverse force, the connector shackle for this purpose having a spherical bearing surface (**55**) articulated to a portion of the spherical surface of the cup (**57**) of the head (**5**) of the bone-anchoring element; and

a tool (**6**) for angularly positioning the threaded shank (**7**) and its ball (**11**) in the shackle (**3**) or the plate (**16**), comprising a sleeve (**24**) mounted to slide axially inside a socket (**25**), the end of which has a female shape (**9**) for screwing the tightening element while the end of the sleeve is provided with a female shape (**20**) designed to fit over a terminal male shape (**21**) of the threaded shank (**7**) so as to immobilize the threaded shank in terms of rotation in the position corresponding to the rotation-stopping geometry while the tightening element is being fitted using a cavity (**9**) of the socket (**25**).

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